

CLAIMS:

1. A position estimation system (220, 226, 222) for estimating a position of an object (224) in a room (200), comprising:
 - an ultrasound emitter (220) arranged to emit an ultrasound pulse (201);
 - an ultrasound receiver (226) arranged to detect an ultrasound signal (300) based on the pulse (201); and
 - a processor (222) for processing the ultrasound signal (300) to obtain the position, characterized in that
 - one of the emitter (220) and the receiver (226) is attached to the object (224);
- 10 and
 - the processor comprises evaluation means (223) arranged to estimate the position of the object (224) on the basis of the ultrasound signal (300) in a first time interval (318), the first time interval (318) comprising ultrasound energy of at least a first reflection (230) of the pulse (201) on a reflecting object (232).
- 15 2. A position estimation system (220, 226, 222) as claimed in claim 1, comprising a storage means (225), arranged to store a first ultrasound signal template (320) corresponding to a first position of the object (224) and a second ultrasound signal template (330) corresponding to a second position of the object (224), and the evaluation means (223) is arranged to compute a first match by evaluating a predetermined match function with as arguments the ultrasound signal (300) in the first time interval (318) and the first template (320) in a first template interval (328), and a second match by evaluating the predetermined match function with as arguments the ultrasound signal (300) in the first time interval (318) and the second template (330) in a second template interval (338).
- 20 25 3. A position estimation system (220, 226, 222) as claimed in claim 2, comprising collecting means (255), arranged to collect the first template (320) and the second template (330) on the basis of ultrasound signal measurements by the receiver (226), with the

object positioned at positions in the room (200) corresponding to the first resp. the second position.

4. A position estimation system (220, 226, 222) as claimed in claim 2,
5 comprising simulation means (227), arranged to generate a candidate first and the second position of the object (224) and to calculate the first template (320) and the second template (330) on the basis of the pulse (201), predetermined characteristics of the room (200), and the first resp. the second position.

- 10 5. A position estimation system (220, 226, 222) as claimed in claim 1,
comprising optimization means (229), arranged to predict a predicted position of the object (224) and to evaluate a third ultrasound signal template on the basis of the pulse (201),
predetermined characteristics of the room (200) and the predicted position.

- 15 6. A position estimation system (220, 226, 222) as claimed in claim 2, arranged
to have the storage means (225) contain more than one ultrasound signal template for a
hypothetical position of the object, and in which the processor (222) is arranged to estimate
besides the position of the object (224) a further parameter.

- 20 7. A position estimation system (220, 226, 222) as claimed in claim 6, in which
the processor (222) is arranged to estimate as the further parameter an orientation (a) of the
object (224).

- 25 8. A position estimation system (220, 226, 222) as claimed in claim 1, in which
one of a second receiver (228) and a second object emitter (630) is attached to the object
(224), and the processor (222) being arranged to estimate the position of the object (224)
based on the ultrasound signal (300) detected by the receiver (226) and on a second
ultrasound signal detected by the second receiver (228), respectively based on the ultrasound
signal (300) detected on the basis of the pulse (201) emitted by the emitter (220) and on the
30 second ultrasound signal detected on the basis of a second pulse emitted by the second object
emitter (630).

9. A position estimation system (220, 226, 222) as claimed in claim 7, in which
the receiver (226) or the emitter (220) is attached to the object (224), and a second receiver

- (228) respectively a second object emitter (630) is attached to the object (224), and in which the processor (222) is arranged to estimate the orientation (a) of the object (224) based on the ultrasound signal (300) detectable by the receiver (226) and a second ultrasound signal detectable by the second receiver (228), respectively based on the ultrasound signal (300)
- 5 detectable on the basis of the pulse (201) emitted by the emitter (220) and the second ultrasound signal detectable on the basis of a second pulse emitted by the second object emitter (630).
- 10 10. A position estimation system (220, 226, 222) as claimed in claim 1, in which a plurality of emitters or receivers is comprised attached to the object (224) or fixed in the room (200), arranged in at least one array, to create a number of pulses of different shapes and orientations respectively to receive pulses impinging on the array of receivers from different orientations and in different solid angles.
- 15 11. A position estimation system (220, 226, 222) as claimed in claim 1, in which the emitter (220) is attached to the object (224), and is arranged to emit the pulse (201) comprising frequencies in at least one predetermined frequency band characteristic for the object (224).
- 20 12. A position estimation system (220, 226, 222) as claimed in claim 1, in which the object (224) is capable of moving or being moved, and tracking means (270) are comprised, arranged to track along a trajectory the position of the object (224).
13. An apparatus for estimating a position of an object (224) in a room (200)
- 25 comprising:
- an ultrasound receiver (226) arranged to detect an ultrasound signal (300) based on an emitted ultrasound pulse (201); and
 - a processor (222) for processing the ultrasound signal (300) to obtain the position, characterized in that the processor comprises evaluation means (223) arranged to estimate the position of the object (224) on the basis of the ultrasound signal (300) in a first time interval (318), the first time interval (318) comprising ultrasound energy of at least a first reflection (230) of the pulse (201) on a reflecting object (232).

14. A method of estimating a position of an object (224) in a room (200), comprising:
- emitting an ultrasound pulse (201);
 - detecting an ultrasound signal (300) based on the pulse (201); and
- 5 - processing the ultrasound signal (300) to obtain the position, characterized in that
- the pulse is emitted from a position adjacent to the object (224) or the ultrasound signal (300) is detected in the vicinity of the object (224); and
 - the processing comprises an evaluation of the ultrasound signal (300) in a
- 10 first time interval (318) comprising ultrasound energy of at least a first reflection (230) of the pulse (201) on a reflecting object (232).
15. A computer program product enabling the processor (222) to execute the method claimed in claim 14.